

9.2

Graph and Write Equations of Parabolas

- Goal** • Graph and write equations of parabolas that open left or right.

Your Notes

VOCABULARY

Focus A fixed point that lies on the axis of symmetry of a parabola

Directrix A line that is perpendicular to the axis of symmetry of a parabola

STANDARD EQUATION OF A PARABOLA WITH VERTEX AT THE ORIGIN

The standard form of the equation of a parabola with vertex at (0, 0) is as follows:

Equation	Focus	Directrix	Axis of Symmetry
$x^2 = 4py$	(0, p)	$y = \underline{-p}$	Vertical ($\underline{x = 0}$)
$y^2 = 4px$	(p , 0)	$x = \underline{-p}$	Horizontal ($\underline{y = 0}$)

Example 1 Graph an equation of a parabola

Graph $x = \frac{1}{2}y^2$. Identify the focus, directrix, and axis of symmetry.

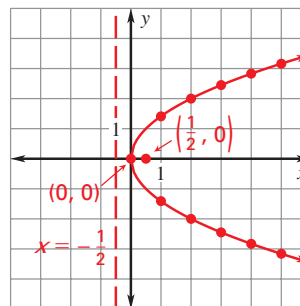
1. Rewrite the equation in standard form.

$$x = \frac{1}{2}y^2 \quad \text{Write original equation.}$$

$$2x = y^2 \quad \text{Multiply each side by } 2.$$

2. Identify the focus, directrix, and axis of symmetry. The equation has the form $y^2 = 4px$ where $p = \frac{1}{2}$. The focus is $(p, 0)$, or $(\frac{1}{2}, 0)$. The directrix is $x = -p$, or $x = -\frac{1}{2}$. Because y is squared, the axis of symmetry is the x-axis.

3. Draw the parabola by making a table of values and plotting points. Because $p > 0$, the parabola opens to the right. So, use only positive x-values.

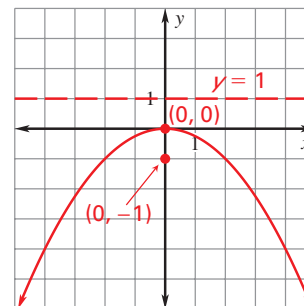


x	1	2	3	4	5
y	± 1.41	± 2	± 2.45	± 2.83	± 3.16

Checkpoint Complete the following exercise.

1. Graph $y = -\frac{1}{4}x^2$. Identify the focus, directrix, and axis of symmetry.

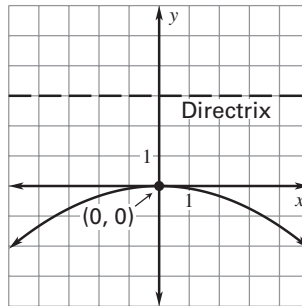
focus: $(0, -1)$; directrix: $y = 1$; axis of symmetry: y -axis, $x = 0$



Your Notes

Example 2 Write an equation of a parabola

Write an equation of the parabola shown.



Solution

The graph shows that the vertex is $(0, 0)$ and the directrix is $y = -p = 3$. Substitute -3 for p in the standard form of the equation of a parabola.

$$x^2 = 4py \quad \text{Standard form, vertical axis of symmetry}$$

$$x^2 = 4(-3)y \quad \text{Substitute for } p.$$

$$x^2 = -12y \quad \text{Simplify.}$$

✓ **Checkpoint** Complete the following exercise.

2. Write the standard form of the equation of the parabola with vertex at $(0, 0)$ and the directrix

$$x = -\frac{3}{4}.$$

$$y^2 = 3x$$

Homework